FAO Plant Protection Bulletin

VOL. V, No. 5 A Publication of the FEBRUARY 1957

World Reporting Service on Plant Diseases and Pests

Chemical Control of the Fall Armyworm, *Laphygma frugiperda* (S.), in Maize in Colombia[1]

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THE fall armyworm, *Laphygma frugiperda* (S.) is the most severe pest of maize, especially in fields in the warmer climates of the lower elevations, the major maize producing areas of Colombia. While sporadically harmful to maize as an armyworm, a cutworm, and to a lesser degree as an earworm, it is as a budworm protected within the whorl of the plant against both natural enemies and insecticides that it is most damaging, most constant in its appearance, and most difficult to control. For these reasons, a study of the control of *L. frugiperda*, based primarily on the suppression of its budworm form, is being made by the entomology section of the Colombian Department of Agricultural Research.

From previous work on the chemical control of this pest,[2] four conclusions were drawn: 1) several insecticides can give excellent kills of the budworms; 2) sprays and baits are more efficient than dusts; 3) applications made when the maize is small are more effective than those made in tall maize; and 4) increases in yield of from 30 to 50 percent can be obtained when the budworm is controlled. A continuation of this work, the comparison of the best materials as to effectiveness and phytotoxicity, is reported in the present paper.

Materials and Methods

Two tests of the comparative effectiveness of selected insecticides in controlling the budworm form of *L. frugiperda* were made in the first season of 1956, one at Palmira in the Cauca Valley, and the other at Medellín, Antioquia. Plots were six rows (5.5 meters) wide by 10 meters long, arranged in a random block design with four replicates. The maize varieties used in the tests were highly productive hybrids; Diacol H-202 at Palmira, and Diacol H-203 at Medellín. The land at Palmira was very uniform, well drained, and sufficiently fertile to grow a good crop without the use of chemical fertilizers. At Medellín the land was heterogeneous and poorly drained, and heavy fertilization was needed.

In Palmira and Medellín the following insecticides were tested at the rate indicated in Tables 1 and 2:

1) toxaphene, 50 percent emulsifiable concentrate;
2) aldrin, 25 percent emulsifiable concentrate;
3) heptachlor, 25 percent emulsifiable concentrate;

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[1] The studies and observations on which this paper is based were conducted under the auspices of the Department of Agricultural Research of the Colombian Ministry of Agriculture with the cooperation of the Rockefeller Foundation.

Paper No. 53 of the Agricultural Journal Series of The Rockefeller Foundation.

[2] RUPPEL, R.F., C. CARMONA B., A. FIGUEROA P. and N. DELGADO M. 1956. El control del cogollero, *Laphygma frugiperda* (A.y.S.), en maíz en Colombia; con anotaciones sobre otras especies. Agricultura Tropical, 12 (8): 499-524.

TABLE 1. *Results of test of the comparative effectiveness of selected insecticides in controlling the budworm form of* Laphygma frugiperda *(S.) in maize, Palmira, 1956.*

Insecticide	Form	Dosage in kg./ha.	Plants 20-30 cm. high		Plants 1 m. high		Yield in kg./sample
			Number of plants[a]	Number living larvæ[a]	Number damaged plants[b]	Stand[b]	
Toxaphene	50 % emul.	2.00	198.25	75.00	26.50	170.25	12.43
Aldrin	25 % emul.	0.50	193.25	67.25	166.50	27.25	12.50
Heptachlor	25 % emul.	0.50	197.25	131.50	176.00	40.75	12.55
Isodrin	25 % w.p.	0.50	188.50	55.25	171.25	27.75	11.85
Parathion	50 % emul.	0.25	195.75	69.75	149.25	19.25	11.03
Untreated	—	—	183.25	130.25	5.00	5.00	00.00
LSD-05 between treatments[c]	—	—	insignificant	28.43	insignificant	insignificant	insignificant

[a] Average of four replications. The four central rows of each plot were used as the sample; counts were made at the time of the second application of the insecticides.

[b] Average of four replications. The four central rows of each plot were used as the sample. Stand refers to number of well-developed plants.

[c] LSD-05 refers to the least difference required for significance.

4) isodrin, 25 percent wettable powder;
5) parathion, 50 and 47 percent emulsifiable concentrate.

Two additional materials were tested in Medellín only:

1) endrin, 18.5 per cent emulsifiable concentrate;
2) toxaphene, bait.

The toxaphene bait was made by mixing one liter of toxaphene emulsifiable concentrate with 4 liters of water and 12.5 kilograms of wheat bran.

Each insecticide was applied three times: 1) at the time of full germination of the maize; 2) when the maize was 20 to 30 centimeters high; and 3) when the maize was 50 to 60 centimeters high. Sprays were applied with compressed air sprayers at the rate of approximately 400 liters per hectare. The bait was applied by hand to the whorl of each plant at a rate of 25 kilograms per hectare.

Counts were made of the number of plants per plot, of the number of living larvæ found in 20 plants per plot at the time of the second insecticide application, and of the total number of plants with fresh damage in the whorl when the plants were about one meter high. At Medellín a count was also made of the number of plants with fresh damage in the whorl at the time of the last insecticide application. In addition, the plants were checked periodically for late damage and any evidence of phytotoxicity. The yield from each plot was recorded and the data were analyzed by the analysis of variance method.

Results and Discussion

The untreated plots at Palmira became heavily infested through repeated migrations of the budworm form of *L. frugiperda* and were severely damaged by the cutworm form of this pest. The data obtained from this test are summarized in Table 1.

With the exception of the stand count made at the time of the second application of insecticides and the number of living larvæ found in the plots treated with heptachlor, all the results obtained in the treated plots varied significantly from those obtained in the untreated ones. No evidence of phytotoxicity was observed in the treated plots, and they remained free of worms until harvest. The untreated plots were either lost or else so stunted by the worms that they yielded nothing.

At Medellín the untreated plots became heavily infested with the budworm form of *L. frugiperda*, and some plants were lost. No cutworms were noted in these plots. In this test also the results obtained in the treated plots were significantly different from those obtained in the untreated plots, again with the exception of the stand count made at the time of the second application. No significant differences existed between the treatments in any of the counts except for the reduced effectiveness of the toxaphene bait shown in the count made at the time of the third application. Chlorosis, slight necrosis, and roughening of the central leaves of the whorl were noted in some of the plants treated with aldrin and isodrin. All the treated plots remained free of worms until harvest. The increase in yield of the average of all treated plots over untreated was 29 percent. The results of the Medellín test are summarized in Table 2.

Apart from the fact that there were no other species of Phalænid worms present to complicate the work, as has sometimes been the case, these tests are good examples of

TABLE 2. *Results of a test of the comparative effectiveness of selected insecticides in controlling the budworm form of* Laphygma frugiperda (*S.*) *in maize, Medellín, 1956.*

Insecticide	Form	Dosage in kg./ha.	Plants 20-30 cm. high		Plants 50-60 cm. high	Plant 1 m. high		Yield in kg. /sampl
			Number plants [a]	Number living larvæ [a]	Number damaged plants [b]	Number damaged plants [c]	Stand [c]	
Toxaphene	Bait		346.75	2.25	76.75	294.25	6.50	26.38
Toxaphene	50 % emul.	2.00	343.00	3.25	32.75	292.75	7.00	26.35
Aldrin	25 % emul.	0.50	345.75	0.50	19.25	293.25	3.00	23.78
Heptachlor	25 % emul.	0.50	344.75	0.00	23.75	290.75	3.25	24.78
Isodrin	25 % w.p.	0.50	358.25	1.25	31.75	297.25	3.75	29.33
Endrin	18.5% emul.	0.25	361.25	0.00	5.00	297.00	1.00	24.00
Parathion	50 % emul.	0.25	326.50	0.25	12.25	273.00	3.00	25.78
Untreated	—	—	337.00	17.25	208.75	178.00	182.50	19.98
LSD-05 between treatments [d]	—	—	insignificant	insignificant	28.20	insignificant	insignificant	insignificant

[a] Average of four replications. The six rows of each plot were used as the sample and the counts were made at the time of the second application of insecticides.

[b] Average of four replications; count was made at the time of the third application of insecticides.

[c] Average of four replications; counts were made at the time of the last application of insecticides.

[d] LSD-05 refers to the least difference required for significance.

Figure 1. Maize treated three times between full germination of the crop and the time the plants were about 50 centimeters tall.

the degree of variation in intensity of damage, in forms of *L. frugiperda*, and of the increased yields encountered in our investigations. Comparisons of the two tests are not valid unless this variation is kept in mind. At Palmira, for example, the lower mortality of the budworms was due to the extremely high population and to the migration of worms into the field, while the major part of the reduced yield was caused by the cutworm form of *L. frugiperda*. At Medellín the population of the insect was also very high, although not as extreme as at Palmira, and the loss of stand was appreciable, amouting to 64 percent. In the Medellín test, it was possible for the first time to attribute an appreciable loss of maize solely to damage by the budworm form (Figures 1 and 2). This test was also the first occasion that the hybrid H-203 was used in these investigations, and the loss of stand may have been due to this hybrid being more susceptible to the budworm than the varieties used previously. However, the rather slight loss of yield would seem to indicate that H-203 is still tolerant to attacks by *L. frugiperda*.

The failure of heptachlor to give satisfactory control of the young worms at Palmira was probably the result of a combination of lack of effective residue and heavy migration of the worms. This migration was not a factor at Medellín. The reduced kill of the toxaphene bait at Medellín may have been due either to the lack of effective residue or to delayed mortality. The effectiveness of both heptachlor and the toxaphene bait as measured in control and yield was not impaired by these early failures, nor did the phytotoxicity noted with aldrin and isodrin at Medellín affect the yield appreciably.

In general spray applications of at least 400 liters per hectare of an emulsion containing 2.0 kilograms of toxaphene or 0.5 kilogram of aldrin proved to be the most practi-

cal means of treating the larger fields with the equipment available, whereas bait was used where the fields were too small or too wet to permit operating the spray machinery. In the tropical areas of Colombia, the applications were made at about the time of each cultivation; this schedule has since been modified to include a pre-emergence application to control cutworms in fields that are weedy at the time of planting. An additional application of bait has also been necessary to control cutworms in fields that are weedy at the time of planting. An additional application of bait has also been necessary to control the armyworms that attack the maize between the time of the last application and the tasseling of the plant.

In the highlands of Colombia, the principal budworm of maize is *Dargida gramivora* Walker. Since this species will attack maize that is more than a meter tall, the final application of insecticide must be delayed until the maize has reached this height. Toxaphene has proved phytotoxic in this final application, and aldrin has been used instead.

Conclusions

In tests of the comparative effectiveness of three applications of different insecticides to young maize in controlling the budworm form of the fall armyworm, *Laphygma frugiperda* (S.), the following results were obtained:

1) Sprays of toxaphene at the dosage of 2 kilograms per hectare, aldrin at 0.5 kilogram per hectare, isodrin at 0.5 kilogram per hectare, endrin at 0.25 kilogram per hectare, and parathion at 0.25 kilogram per hectare were equally effective.

Figure 2. Untreated maize. Note the differences in height and stand and in amount of leaf damage caused by *Laphygma frugiperda* as compared with treated maize in Figure 1.

2) A spray of heptachlor at 0.5 kilogram per hectare and a 5 percent bait of toxaphene failed to achieve complete mortality of the young worms. However, the end result with these materials, as measured in mortality of worms and yield of maize, was the same as that obtained with the other materials.

3) Aldrin and isodrin were slightly phytotoxic but this phytotoxicity did not affect the yield of the crop.

Applications of these materials at the time of each cultivation of the maize are suggested as a practical method of controlling the budworm form of *L. frugiperda* in maize in Colombia.

Khapra Beetle Eradication

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DURING the two years of concerted effort by the State and Federal Governments and the grain handling industry to find and eradicate the khapra beetle (*Trogoderma granarium* Evarts) in the United States and northern Mexico, the insect has been eradicated on 382 of the 455 known infested sites. Nearly 114 million cubic feet of storage space has received fumigation treatment in the all-out action to rid the Southwest of this important storage pest.

The khapra beetle is a native of India, Malaya, and other southeast Asian countries and has become established in parts of Europe, Africa, Australia, and the Orient. It was first reported in California in 1953 and since then has been found in Arizona, New Mexico and the Republic of Mexico. In the

Figure 1. Khapra beetle cast skins in barley. In stored grains the loss sometimes amounts to as much as 25 percent or more.

brief time that it has been known in the United States of America its importance to the national agricultural economy has become fully recognized. The khapra beetle thrives in a wide range of temperatures. It is a voracious feeder on stored foods and feed products and under optimum conditions populations build up in almost an explosive manner (Figure 1).

The habit of the larva of secreting itself in cracks and crevices, its ability to resist starvation for long periods of time, and its resistance to normal sanitation measures make it a formidable pest of the grain and feed industry. This insect's habit of moving to the outside of storage structures under the pressure of large population build-up necessitates exterior wrap-up fumigation as an eradication procedure.

Quarantine Regulations

The organized khapra beetle program began with the promulgation of the Federal quarantine in February of 1955. This quarantine departs from the usual concept of insect pest regulations in that it does not apply to definite political subdivisions or well-defined geographical boundaries but, instead, applies only to properties which have been found infested. It is a premise type quarantine wherein only the site of the infestation and all buildings of common usage on the site are placed under regulation.

Quarantine enforcement with this insect is complex because of its habit of feeding on anything of plant or animal origin and of crawling onto or into anything with which it comes in contact. The khapra beetle does not

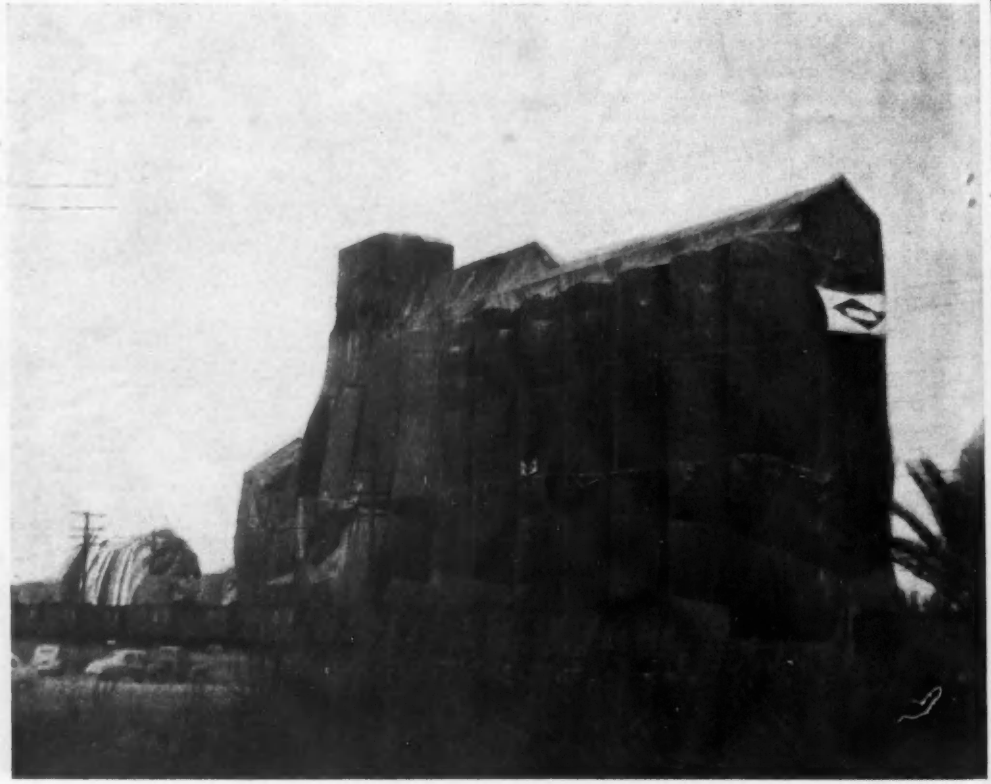

Figure 2. Grain elevator and warehouse wrapped in gastight, plasticized tarpaulin preparatory to fumigation with methyl bromide.

TABLE 1. *Cumulative summary of the inspection and treatment program for the eradication of the khapra beetle.*

Locality	Total number of infested sites	Total volume of infested sites (in cu. ft.)	Number of sites treated	Total volume treated and released (in cu. ft.)
Arizona	133	53,508,462	98	33,909,931
California	279	75,380,000	258	71,801,078
New Mexico	5	415,400	5	415,400
Republic of Mexico	38	11,580,000	21	5,294,009
Total	455	140,883,862	382	110,915,418

move far under its own power but excels as a hitchhiker in grain, feed, seed and in the seams of burlap bags and other types of containers. All host materials and other articles that constitute a hazard for spread when moved from infested sites are subject to commodity treatment with methyl bromide.

Distribution Surveys

When a decision was made to eradicate this insect, comprehensive surveys were started in the three known infested States and many important sites in other States. Under the premise type quarantine it was important that all plants engaged in interstate trade be inspected first and, if found infested, placed under regulation. The survey was then extended to sites that had received commodities from infested plants, next to retail outlets with host products, and later to farm and ranch storage buildings and feed lots, as it is essential to locate and treat all infested sites both large and small if the eradication program is to be effective. Early in 1956 a similar survey was started in the States of Sonora and Baja California of the Republic of Mexico.

During the inspection program more than 45,000 sites have been inspected one or more times with an aggregate of 60,000 inspections in 37 States. Some 900 inspections have been made in the two States of the Republic of Mexico. As a result of this work 455 infested sites have been found as follows: Arizona, 133; California, 279; New Mexico, 5; and the Republic of Mexico, 38.

Eradication Program

Eradication is accomplished by fumigation with methyl bromide. Entire storage structures, some of nearly 5 million cubic feet in volume, are wrapped in a gastight tarpaulin (Figure 2) and charged with the fumigant at the rate of 5 pounds per thousand cubic feet. To assure complete mortality of the insect in all stages of development, the gas concentration must be held at 32 ounces per 1,000 cubic feet during any continuous 24 hours of the 48 hours that the structures are under the wraps. This is the largest fumigation operation of its kind ever undertaken for eradicating an insect. It is the first time that large storages were completely wrapped for fumigation.

The largest single treatment completed was a warehouse and mill located at Fresno, California. This property contained 4,850,000 cubic feet. Nine and one-half acres of tarpaulin were required to cover the structure, and more than 35,000 clamps were used to hold the tarpaulin together. Sixteen tons of methyl bromide were used in the fumigation treatment, which was fully effective.

The 455 infested sites have a storage volume requiring treatment of more than 140,000,000 cubic feet. By 1 December 1956, 382 of those sites, with a volume of 111 million cubic feet had received the eradication fumigation treatment and were released from the quarantine regulations (Table 1).

Distribution of Legume-Infesting Therioaphidine Aphids

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APHIDS have long been recognized as serious pests of legumes, plants of exceptional agricultural value throughout the world. Much information has been available on the more common, injurious species, but there has been little knowledge of the less common, presumably less injurious ones.

However, since the discovery of an injurious therioaphidine aphid on alfalfa in the southwestern United States early in 1954 and its subsequent spectacular spread and destructiveness, it has become imperative to obtain as much information as possible about the distribution, habits and identity of this group of aphids attacking clovers and related legumes. This is a report on the results of an attempt to ascertain the distribution of these insects.

Characteristics of the Group

The aphids under consideration may be recognized by their greatly enlarged fore coxae and the unusual habit, for aphids, of jumping. On the upper surface of the body are sclerotized areas that are light and rather obscure in some species but dark and conspicuous in others. The insects live primarily or exclusively on clovers and closely related legumes. Each species apparently has a host preference even though it may occasionally live on a related plant, and its distribution appears to be restricted to that of its preferred host. The insects apparently originated in the Old World, whence some species have spread to other parts of the world.

The Spotted Alfalfa Aphid

A species appropriately designated the spotted alfalfa aphid, currently known as *Therioasphis maculata* (Buckton) or *Pterocallidium* sp., because it has black spots and lives primarily on alfalfa, is distributed around the globe. It is found in France, Germany, Hungary, Italy, Yugoslavia, Morocco, Egypt, Cyprus, Turkey, Israel, Iraq, Iran, Pakistan, India, China, Mexico and the United States. In approximately three years it has spread from the southwest to all parts of the United States except the more northerly areas. It is a menace to alfalfa throughout its range.

The Yellow Clover Aphid

A species commonly called the yellow clover aphid, *Pterocallidium trifolii* (Monell), because of its yellow color, occurs normally on red clover and sometimes lives on white or other clovers, but apparently will not survive on alfalfa. This species doubtless is widespread in Europe, and certainly occurs in France, Germany and the Netherlands. It is also present in Egypt, Iran and America. It is distributed in the eastern and central portions of the United States, but has not invaded the arid or northwestern areas in the 75 years that it has been known here.

The Sweet Clover Aphid

The sweet clover aphid, *Myzocallidium riehmi* Börner, is found almost exclusively on sweet clover. This aphid doubtless is present in much of Europe, as it is known to occur in England, France, Germany and the Netherlands. Specimens have also been seen from Iran. In America it is established from the Atlantic Ocean to the Pacific and from the southern borders of the United States northward into Canada.

Other Aphids

In addition to these three species, one is known on *Ononis* over much of Europe, Iran and perhaps elsewhere in Asia and an-

other is present on *Caragana* in China. Other species are present in Europe on clovers, and three are fairly widely distributed, but the others are known only from restricted areas.

It is desirable that the identity of aphids associated with legumes be determined whenever they are found, even though the insects may not be particularly injurious under local conditions. Their destructiveness can increase greatly and quickly by the introduction either of new varieties of plants into areas where the insects are already established or of the insects into previously uninfested areas where different crop varieties are grown.

Plant Quarantine Announcements

Switzerland

Federal Order of 27 November 1956, published in the *Recueil des Lois fédérales*, No. 50, 28 November 1956, decrees the following provisions for the importation of seed potatoes to prevent the introduction of potato eelworm (*Heterodera rostochiensis*). These provisions do not apply to frontier traffic or seed potatoes in transit which are neither unloaded or stored on Swiss territory.

1. Consignments of seed potatoes will only be permitted entrance if the Plant Protection Service has authorized their clearance through customs. Importation is limited to the following customs stations:

Basel-SBB Frachtgut
Basel-St. Johann
Basel-Badischer Bahnhof
Basel-Muttenz
Waldshut
Schaffhausen-Bahnhof
Konstanz
Romanshorn
St. Margrethen-Bahnhof
Buchs
Genève-Cornavin
Vallorbe-Gare
Le Locle

2. Normally importation will be authorized by the Plant Protection Service if the potatoes are accompanied by a phytosanitary certificate as described below and if such samples as may have been taken have been found to be free from nematodes. If no certificate is produced, the goods will not be cleared until such a document is available, unless the Division of Agriculture grants an exceptional license under special conditions.

a) For seed potatoes exported by countries which are signatories to the International Plant Protection Convention, 1951, the model certificate will be accepted if it includes the additional declarations that 1) the seed potatoes are free from potato root eelworm; and 2) that the fields in which they were grown were examined and found to be free from the nematode.

b) For seed potatoes from other countries, the certificate must give the name and address of the exporter; the locality where the produce was grown and the name and address of the grower; the variety, the number of the railway wagon, the description and marks of the packages; the place of destination and the address of the consignee; a declaration that the seed potatoes are free from potato root eelworm and that the fields in which they were grown were examined and also found to be free from the pest; the place and date of issue of the certificate and the stamp and signature of the competent plant protection service in the country of origin.

3. As methods to determine whether fields are free from potato root eelworm, the so-called Dutch and United Kingdom methods as applied in the case of exports will be accepted. The certificates mentioned under (2-*a*) and (2-*b*) may be combined with a declaration concerning potato wart disease (*Synchytrium endobioticum*). The certificates will be valid for a maximum period of 30 days from the date of issue. They must be made out in French, German or Italian. Certificates in other languages will only be accepted if the importer provides a reliable translation.

4. If circumstances so require, the Federal Department of Public Economy may:

a) decree that the importation of seed potatoes from countries known to be infested will be subject to more stringent requirements or be totally prohibited;

b) extend the rules laid down in this Order to other products which might carry the pest, such as tomato seedlings and vegetables mould;

c) decide not to refuse infested or suspected produce but to permit its importation after disinfestation by a prescribed method.

Union of South Africa

Proclamation No. 2002 of 2 November 1956, published in the *Government Gazette*, Vol. 186, No. 5764 of 2 November 1956, prohibits, based on section 8 of the Weed Act 1937 as amended, the

introduction into the Union from any place outside the Union of the following weeds and seeds of weeds:

1. Parrotsfeather (*Myriophyllum* spp.) and any other plant belonging to the family Halorhagidaceæ.

2. Water fern (*Salvinia* spp.) and other plants belonging to the family Salviniaceæ.

3. Water pest (*Anachharis* spp. or *Elodea* spp.) and other plants belonging to the family Hydrocharitaceæ.

4. Water hyacinth (*Eichhornia* spp.) and other plants belonging to the family Pontederiaceæ.

5. Duckweed or duck's meat (*Lemna* spp.) and other plants belonging to the family Lemnaceæ.

News and Notes

European and Mediterranean Plant Protection Organisation

Meetings convened by the European and Mediterranean Plant Protection Organisation (EPPO) in 1956 included international conferences on the fall webworm (*Hyphantria cunea*) and the Mediterranean fruit fly (*Ceratitis capitata*), and selected Working Parties on the Tristeza and Xyloporosis Diseases of Citrus and on the Simplification and Unification of Phytosanitary Regulations. Reports on all these meetings will be published in the near future, except that the report on the last-named working party will be first submitted for the approval of the EPPO Council at its meeting in April 1957.

The ravages of the fall webworm (*Hyphantria cunea*), which found its way to Europe from America in the course of the second world war, are still a matter for considerable concern. Countries known to be infested include Austria, Czechoslovakia, Hungary, Rumania and Yugoslavia. From the last-named country, where the pest has already established itself as far west as Zagreb, there is a real danger that it may spread to Italy, endangering her important natural silk industry, and thence to France. Discussions are taking place between representatives of EPPO and the three countries concerned, from which may emerge a special control campaign in the area west of Zagreb, designed to prevent, or at least delay, the westward extension of the pest.

The conferences on the Mediterranean fruit fly and on tristeza and xyloporosis revealed the common need for a mission of experts to visit the countries in the Mediterranean area and initiate coordinated programs of work. The programs would be designed, in the case of the Mediterranean fruit fly, to lead to more effective control measures and to the adequate treatment of fruit for export so as to kill any infestation and thereby protect importing countries in which the pest might otherwise establish itself. In the case of tristeza and xyloporosis, the mission would encourage systematic surveys of citrus plantations, coordinate experiments to ascertain the best stock-scion combinations for use under commercial conditions and introduce a graft-indexing procedure for the testing of imported propagating material as a safeguard against introduction of tristeza, which could cause immense losses if it became widespread in the Mediterranean area.

EPPO has decided to act on this recommendation of the two conferences and it is hoped that an expert mission comprising an entomologist and a virologist will, with the cooperation of Mediterranean governments, visit the countries concerned during the spring and summer of 1957.

The Working Party on Phytosanitary Regulations discussed and made recommendations on a wide range of subjects, including (1) the difficult question of the responsibilities of plant protection services in relation to the transit of plants and plant products through their countries, either by direct passage, or indirectly, involving the unpacking, handling and perhaps the temporary storage of the produce before re-export; (2) the relationship which should exist between plant protection services and the trades; (3) the usefulness or otherwise of requiring phytosanitary certificates to accompany small parcels of produce sent by post, rail or road; (4) the need for establishing uniform standards of fumigation of plants and plant products; (5) the phytosanitary significance of the growing practice of packing plants and plant products in plastic film containers; (6) the justification for including "distance" requirements in phytosanitary regulations; and (7) the rules which should govern the inspection of produce for export. As stated above, the report will not be published until the recommendations have been approved by the Council.

EPPO muskrat control campaigns are already under way in certain districts of Belgium (to protect the Netherlands from invasion) and of Schleswig-Holstein and Lower Saxony (to check the spread northwards towards Denmark); the schemes are assisted financially by the Dutch and Danish governments respectively. More recently, in view of the growing danger to Belgium of the rapid increase of the muskrat population in northwesten France, a control campaign has been initiated in the Lys and Yser valleys. The cost of the campaign is being met by grants to EPPO made by the Belgian government, the French Ministries of Agriculture and Public Works, and the Prefectures of the Departments Nord and probably Pas-de-Calais. It has been further arranged that early in 1957 a coordinated control campaign will be started on both sides of the Austro-German frontier; the German government will contribute some part of the cost of the scheme in operation on the Austrian side of the frontier, and the trappers who will work in this area will be trained in Germany.

The threat to Denmark of invasion by the Colorado potato beetle (*Leptinotarsa decemlineata*) became more serious in 1956, when many beetles were found in Danish potato fields. A special control campaign was started last year in the four northern "Kreise" of Schleswig-Holstein, in an attempt to protect Denmark from further invasion. Financial assistance toward the cost of this campaign is given by the Swedish government. EPPO has convened an early meeting of representatives of the three governments concerned, to review the position and make arrangements for the 1957 campaign.

The next meeting of the EPPO Council will be held in Marseille on April 10-11, 1957. Meetings of the Executive Committee have been arranged for February 26 and April 9, 1957.

FAO Meeting on Senn Pest

The First FAO Meeting on the Control of the Senn Pest (*Eurygaster integriceps* Put.), convened in Ankara, Turkey, December 3 to 7, 1956, was attended by delegates from Iran, Syria and Turkey, and observers from Morocco, the Union of Soviet Socialist Republics and the United States of America. Discussions included such items as: the geographic distribution of the pest, the nature and importance of its damage, its biology and ecology in the wintering and invasion areas, the frequency of outbreaks, and control measures for use in both wintering and invasion areas. The meeting also considered the availability of personnel and facilities for future investigations, the possibility of developing regional cooperation and the extent to which FAO might assist its Member Governments in the control of this widely distributed pest.

Discussions centered on the ecology of the senn pest and its control. While the prevalence and resulting losses fluctuated considerably from year to year in some areas, it was found to be a serious pest every year in other areas. Considerable progress has been made in the biological control of the senn pest by the laboratory rearing and liberation of large numbers of the egg parasite *Microphanurus semistriatus* Nees. The ecology and the control of the pest will become the subject of intensified studies in the near future. Chemical control methods have given encouraging results but the costs are high. Better and cheaper means must be obtained before chemical methods are to be accepted and widely used by farmers.

The meeting stressed the need for close international cooperation and recommended that FAO should provide technical assistance and should coordinate the development of economical and effective control measures for the senn pest.

Roma - Tip. del Senato del dott. Giovanni Bardi